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**ARCS**

Remedial Planning Activities at Selected  
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Sites in the Zone of Regions IX and X

2363-00053

SDMS DOC ID 88152226

*NEWMARK Groundwater Contamination Superfund Site*

# **NEWMARK Operable Unit RI/FS Report**

## **Volume 1**

**Contract No. 68-W9-0054/WA No. 54-10-9LJ5**

**URS**  
Consultants, Inc.

**Team Subcontractors:**

B & V Waste Science and Technology Corp.  
Shannon and Wilson, Inc.  
Ecologics Environmental Consulting Companies, Inc.

AR 0179

**REMEDIAL INVESTIGATION/  
FEASIBILITY STUDY REPORT  
FOR  
NEWMARK RI/FS GROUNDWATER  
CONTAMINATION PROJECT**

**Prepared for:**

**Contract No. 68-W9-0054 / WA No. 54-10-9LJ5  
U.S. Environmental Protection Agency  
Region IX  
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San Francisco, California 94105**

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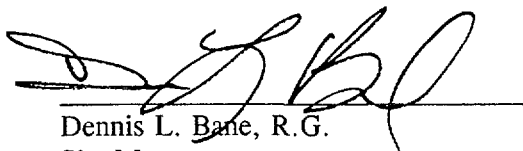
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NEWMARK OPERABLE UNIT RI/FS REPORT  
URS Consultants, Inc.  
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Page iii of xvi

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## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
<b>VOLUME 1</b>	
<b>FRONT MATTER</b>	
Identification Form . . . . .	i
Approval Form . . . . .	ii
Record of Changes . . . . .	iii
Distribution List . . . . .	iv
TABLE OF CONTENTS . . . . .	v
ABBREVIATIONS LIST . . . . .	xiv
EXECUTIVE SUMMARY . . . . .	ES-1
<b>1.0 INTRODUCTION . . . . .</b>	<b>1-1</b>
1.1 PURPOSE . . . . .	1-2
1.2 BACKGROUND . . . . .	1-3
1.2.1 History of Regulatory Actions and Investigations . . . . .	1-3
1.2.2 History of Suspected Source of Contaminants . . . . .	1-4
1.2.3 RI/FS Areas . . . . .	1-5
1.3 REPORT ORGANIZATION . . . . .	1-11
<b>2.0 REGIONAL SETTING . . . . .</b>	<b>2-1</b>
2.1 SURFACE FEATURES . . . . .	2-1
2.2 CLIMATE . . . . .	2-2
2.3 GEOLOGY . . . . .	2-5
2.4 HYDROGEOLOGY . . . . .	2-7
2.5 STUDY AREA DEMOGRAPHY AND LAND USE . . . . .	2-9
<b>3.0 SITE INVESTIGATION . . . . .</b>	<b>3-1</b>
3.1 SOURCE AREA . . . . .	3-1
3.1.1 Source Area Well Location Rationale . . . . .	3-3
3.1.2 Well Boring Geophysics . . . . .	3-5
3.1.3 Suspected Source Area Well Installation . . . . .	3-6
3.1.4 Source Area Sampling Rationale . . . . .	3-11
3.1.5 Groundwater Samples . . . . .	3-14
3.2 PLUME AREA . . . . .	3-16
3.2.1 Plume Well Installation . . . . .	3-18
3.2.2 Waterloo® Sampling System Installation . . . . .	3-22
3.2.3 Plume Well Sampling . . . . .	3-22
3.3 MUNICIPAL WELL SAMPLES . . . . .	3-24
3.3.1 Municipal Well Sampling . . . . .	3-24

## TABLE OF CONTENTS (Cont'd.)

<u>Section</u>	<u>Page</u>
3.4 ANALYTICAL METHODS AND DATA QUALITY EVALUATION . . . . .	3-28
3.4.1 Region IX Laboratory Analyses . . . . .	3-29
3.4.2 FASP Mobile Laboratory Analyses . . . . .	3-29
3.4.3 Data Quality Evaluation . . . . .	3-31
4.0 INVESTIGATION AREA CHARACTERISTICS . . . . .	4-1
4.1 SUSPECTED SOURCE AREA . . . . .	4-1
4.1.1 Soil and Geology . . . . .	4-1
4.1.2 Hydrogeology . . . . .	4-8
4.2 PLUME AREA . . . . .	4-12
4.2.1 Soils and Geology . . . . .	4-12
4.2.2 Hydrogeology . . . . .	4-14
5.0 NATURE AND EXTENT OF CONTAMINATION . . . . .	5-1
5.1 SUSPECTED SOURCE AREA . . . . .	5-1
5.1.1 Soil . . . . .	5-1
5.1.2 Groundwater . . . . .	5-5
5.2 PLUME AREA . . . . .	5-14
5.3 VOLUMES AND MASS . . . . .	5-27
6.0 CONTAMINANT FATE AND TRANSPORT . . . . .	6-1
6.1 CONTAMINANT CHARACTERISTICS AND ENVIRONMENTAL PERSISTENCE . . . . .	6-1
6.1.1 Chemical and Physical Characteristics . . . . .	6-1
6.1.2 Contaminant Fate and Persistence . . . . .	6-2
6.2 SOURCE CHARACTERISTICS AND AFFECTED ENVIRONMENTAL MEDIA . . . . .	6-6
6.2.1 Source Characteristics . . . . .	6-6
6.2.2 Affected Environmental Media . . . . .	6-10
6.3 TRANSPORT MECHANISMS AND PATHWAYS . . . . .	6-12
6.3.1 Transport Mechanisms . . . . .	6-12
6.3.2 Intermedia Transport Pathways . . . . .	6-21
6.4 REVIEW OF PROJECT FLOW MODEL . . . . .	6-24
6.4.1 Grid System . . . . .	6-26
6.4.2 Input Data for Project Flow Model . . . . .	6-26
6.4.3 Flow Model Results of Existing Conditions . . . . .	6-34
6.4.4 Retarded Velocities of TCE and PCE in the Groundwater . . . . .	6-41
7.0 SUMMARY AND CONCLUSIONS . . . . .	7-1
7.1 SUMMARY . . . . .	7-1
7.1.1 Nature and Extent of Contamination . . . . .	7-1
7.1.2 Fate and Transport . . . . .	7-5

## TABLE OF CONTENTS (Cont'd.)

<u>Section</u>	<u>Page</u>
7.2 DATA LIMITATIONS AND RECOMMENDATIONS FOR FUTURE WORK . . . . .	7-7
7.2.1 Groundwater . . . . .	7-8
7.2.2 Source Area . . . . .	7-8
8.0 REMEDIAL ACTION OBJECTIVES . . . . .	8-1
8.1 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND OTHER CRITERIA OR GUIDELINES TO BE CONSIDERED . . . . .	8-1
8.1.1 Definition of ARARs and Other Criteria or Guidelines to be Considered (TBCs) . . . . .	8-1
8.1.2 Identification of ARARs . . . . .	8-2
8.1.3 Identification of Other Guidance and Criteria To-Be-Considered . . . . .	8-10
8.1.4 Summary of ARARs and TBCs . . . . .	8-14
8.2 PRELIMINARY BASELINE RISK ASSESSMENT . . . . .	8-14
8.2.1 Background . . . . .	8-17
8.2.2 Chemical Concentrations . . . . .	8-17
8.2.3 Exposure Pathways . . . . .	8-17
8.2.4 Quantification of Health Risks . . . . .	8-18
8.2.5 Estimated Risks - Quantitative Assessment . . . . .	8-18
8.2.6 Ecological Risks . . . . .	8-19
8.2.7 Conclusions . . . . .	8-19
8.3 REMEDIAL ACTION OBJECTIVES . . . . .	8-20
9.0 GENERAL RESPONSE ACTIONS . . . . .	9-1
9.1 NO ACTION . . . . .	9-1
9.2 INSTITUTIONAL ACTIONS . . . . .	9-1
9.3 COLLECTION/TREATMENT/DISPOSAL . . . . .	9-4
9.3.1 Collection . . . . .	9-4
9.3.2 Treatment . . . . .	9-4
9.3.3 Disposal . . . . .	9-4
9.4 CONTAINMENT . . . . .	9-5
10.0 IDENTIFICATION AND INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS . . . . .	10-2
10.1 MONITORING . . . . .	10-2
10.2 GROUNDWATER USE RESTRICTIONS . . . . .	10-2
10.3 EXTRACTION . . . . .	10-5
10.3.1 Extraction Wells . . . . .	10-5
10.3.2 Municipal Production Wells . . . . .	10-5
10.4 SUBSURFACE DRAINS . . . . .	10-6
10.5 BIOLOGICAL TREATMENT . . . . .	10-6
10.5.1 Aerobic Oxidation . . . . .	10-7
10.5.2 Anaerobic Digestion . . . . .	10-7

## TABLE OF CONTENTS (Cont'd.)

<u>Section</u>	<u>Page</u>
10.6 PHYSICAL/CHEMICAL TREATMENT (ON-SITE) . . . . .	10-8
10.6.1 Aqueous Granular Activated Carbon . . . . .	10-8
10.6.2 Air Stripping . . . . .	10-8
10.6.3 Chemical Oxidation . . . . .	10-10
10.6.4 Reverse Osmosis . . . . .	10-11
10.6.5 Ion Exchange . . . . .	10-12
10.6.6 Precipitation . . . . .	10-12
10.7 OFF-SITE TREATMENT . . . . .	10-12
10.7.1 Publicly Owned Treatment Works (POTW) . . . . .	10-13
10.7.2 Resource Conservation and Recovery Act (RCRA) Facility . . . . .	10-13
10.8 IN-SITU TREATMENT . . . . .	10-13
10.8.1 Biotreatment . . . . .	10-14
10.8.2 Aeration . . . . .	10-14
10.8.3 Permeable Treatment Beds . . . . .	10-14
10.8.4 Chemical Oxidation . . . . .	10-14
10.9 ON-SITE DISCHARGE OF TREATED WATER . . . . .	10-15
10.9.1 Reinjection . . . . .	10-15
10.9.2 Surface Drainage . . . . .	10-15
10.10 OFF-SITE DISCHARGE OF TREATED WATER . . . . .	10-16
10.10.1 POTW . . . . .	10-16
10.10.2 Municipal Water Supply . . . . .	10-16
10.11 VERTICAL BARRIER . . . . .	10-16
10.11.1 Slurry Wall . . . . .	10-17
10.11.2 Grout Curtain . . . . .	10-17
10.11.3 Steel Sheet Piling . . . . .	10-17
11.0 EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS . . . . .	11-1
11.1 MONITORING . . . . .	11-2
11.2 GROUNDWATER USE RESTRICTIONS . . . . .	11-2
11.3 EXTRACTION . . . . .	11-5
11.3.1 Extraction Wells . . . . .	11-5
11.3.2 Municipal Production Wells . . . . .	11-6
11.4 PHYSICAL/CHEMICAL TREATMENT (ON-SITE) . . . . .	11-7
11.4.1 Aqueous GAC . . . . .	11-7
11.4.2 Air Stripping with Vapor Phase GAC Treatment of Off-Gas . . . . .	11-8
11.4.3 Advanced Oxidation . . . . .	11-9
11.4.4 Advanced Oxidation (Ozone/Peroxide) . . . . .	11-9
11.4.5 Advanced Oxidation . . . . .	11-10
11.5 OFF-SITE TREATMENT . . . . .	11-10
11.5.1 POTW . . . . .	11-11
11.6 ON-SITE DISCHARGE OF TREATED WATER . . . . .	11-11
11.6.1 Reinjection . . . . .	11-11
11.6.2 Surface Drainage . . . . .	11-12

## TABLE OF CONTENTS (Cont'd.)

<u>Section</u>	<u>Page</u>
11.7 OFF-SITE DISCHARGE OF TREATED WATER . . . . .	11-13
11.7.1 POTW . . . . .	11-13
11.7.2 Municipal Water Supply . . . . .	11-13
12.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES . . . . .	12-1
12.1 ALTERNATIVE 1: NO ACTION (MONITORING) . . . . .	12-3
12.2 ALTERNATIVE 2: AQUEOUS GAC WITH MUNICIPAL END USE . . . . .	12-4
12.3 ALTERNATIVE 3: AIR STRIPPING WITH OFF-GAS TREATMENT AND MUNICIPAL END USE . . . . .	12-7
12.4 ALTERNATIVE 4: ADVANCED OXIDATION (OZONE/PEROXIDE) WITH MUNICIPAL END USE . . . . .	12-9
12.5 ALTERNATIVE 5: AQUEOUS GAC WITH REINJECTION . . . . .	12-11
12.6 ALTERNATIVE 6: AQUEOUS GAC WITH SURFACE DRAINAGE . . . . .	12-12
12.7 EVALUATION SUMMARY . . . . .	12-14
13.0 DETAILED ANALYSIS OF ALTERNATIVES . . . . .	13-1
13.1 DEVELOPMENT OF EXTRACTION SCENARIOS . . . . .	13-2
13.1.1 Introduction . . . . .	13-2
13.1.2 Extraction Scenarios and Extraction Regions . . . . .	13-2
13.1.3 Review of Project Flow Model . . . . .	13-6
13.1.4 Results of the Extraction Scenarios and Remediation Times . . . . .	13-8
13.2 EVALUATION OF ALTERNATIVES . . . . .	13-24
13.2.1 Alternative 1: No Action (Monitoring) . . . . .	13-29
13.2.2 Alternative 2: Aqueous GAC with Municipal End Use . . . . .	13-35
13.2.3 Alternative 3: Air Stripping with Off-Gas Treatment and Municipal End Use . . . . .	13-53
13.2.4 Alternative 4: Advanced Oxidation (Ozone/Peroxide) with Municipal End Use . . . . .	13-61
13.2.5 Alternative 5: Aqueous GAC with Reinjection . . . . .	13-83
13.3 COMPARATIVE ANALYSIS OF ALTERNATIVES . . . . .	13-91
13.3.1 Overall Protection of Human Health and the Environment . . . . .	13-96
13.3.2 Compliance with ARARs . . . . .	13-96
13.3.3 Long-Term Effectiveness and Permanence . . . . .	13-96
13.3.4 Reduction of Toxicity, Mobility, or Volume . . . . .	13-96
13.3.5 Short-Term Effectiveness . . . . .	13-97
13.3.6 Implementability . . . . .	13-97
13.3.7 Cost . . . . .	13-97

## REFERENCES

## PLATE 1 FEATURES MAP

## TABLE OF CONTENTS (Cont'd.)

### TABLES

Table 2-1	Summary of Annual Average Precipitation in San Bernardino 1951 to 1990
Table 2-2	State and Federal Ambient Air Quality Standards San Bernardino Fourth Street Station No. 203 1990
Table 3-1	Monitoring Well Data-Suspected Source Area
Table 3-2	Monitoring Well Development Data
Table 3-3	Monitoring Well MW01 Well Construction Details
Table 3-4	Municipal Well Information Summary
Table 3-5	EPA Region IX Laboratory RAS & SAS Analyses
Table 3-6	FASP Mobile Laboratory Analyses
Table 3-7	Data Quality Objectives for Water Samples Analyzed by the Mobile Laboratory
Table 3-8	Data Quality Objectives for Soil Samples Analyzed by the Mobile Laboratory
Table 3-9	Data Quality Objectives for Water Samples Analyzed by the EPA Region IX Laboratory
Table 3-10	Data Quality Objectives for Soil Samples Analyzed by the EPA Region IX Laboratory
Table 5-1	Soil Sample Results - Volatile Organics
Table 5-2	Soil Sample Results - Total Metals
Table 5-3	Groundwater Sample Results - Volatile Organics
Table 5-4	Groundwater Sample Results - Total Metals
Table 5-5	Municipal Water/Cal EPA Monitoring Well Sample Results
Table 5-6	Municipal Wells Sampling Results for TCE and PCE (1980-1992)
Table 6-1	Physical Properties of PCE and TCE
Table 6-2	Average Groundwater Velocities for Newmark Plume
Table 6-3	Estimated Retardation Factors ( $R_d$ ) and Velocities of TCE and PCE in the Groundwater
Table 7-1	Contaminants of Concern
Table 7-2	Concentrations of Contaminants of Concern in Groundwater
Table 8-1	Potential State and Federal Chemical-Specific ARARs for the Newmark Operable Unit (December, 1992)
Table 8-2	Potential State and Federal Chemical-Specific TBCs for the Newmark Operable Unit (December, 1992)
Table 8-3	Summary of Potential ARARs and TBCs for the Newmark Operable Unit
Table 9-1	Technologies and Process Options for Groundwater Remedial Action Objectives
Table 10-1	Initial Screening of Technologies and Process Options for Groundwater
Table 11-1	Evaluation of Process Options for Groundwater
Table 12-1	Screening of Groundwater Alternatives
Table 13-1	Summary of Extraction Scenario No. 6
Table 13-2	Summary of Extraction Scenario No. 7
Table 13-3	Summary of Extraction Scenario No. 8
Table 13-4	Cost Basis
Table 13-5	Summary of Alternatives
Table 13-6	Estimated Cost - Alternative 1
Table 13-7	Design Criteria - Alternative 2
Table 13-8	Estimated Cost - Alternative 2: South Plant

## TABLE OF CONTENTS (Cont'd.)

Table 13-9	Estimated Cost - Alternative 2: North Plant
Table 13-10	Design Criteria - Alternative 3
Table 13-11	Estimated Cost - Alternative 3: South Plant
Table 13-12	Estimated Cost - Alternative 3: North Plant
Table 13-13	Design Criteria - Alternative 4
Table 13-14	Estimated Cost - Alternative 4: South Plant
Table 13-15	Estimated Cost - Alternative 4: North Plant
Table 13-16	Design Criteria - Alternative 5
Table 13-17	Estimated Cost - Alternative 5: South Treatment Plant
Table 13-18	Alternative Comparative Analysis
Table 13-19	Comparison of Cost for the Alternatives
Table 13-20	Sensitivity Analysis: Variation of Annual Carbon Usage - Alternative 2
Table 13-21	Sensitivity Analysis: Variation of Air/Water Ratio - Alternative 3
Table 13-22	Sensitivity Analysis: Variation of Dosage Rate - Alternative 4
Table 13-23	Sensitivity Analysis: Variation of Annual Carbon Usage - Alternative 5

## FIGURES

Figure 1-1	Study and Model Areas
Figure 1-2	Investigation Area
Figure 1-3	Suspected Source Area
Figure 1-4	Plume Area
Figure 2-1	Investigation Area Flood Zones
Figure 3-1	Source Area Monitoring Well Locations
Figure 3-2	Generic Well Construction
Figure 3-3	Location of Plume Monitoring Well MW01
Figure 3-4	MW01 Construction Detail
Figure 3-5	Municipal Well Sample Locations
Figure 4-1	Location of Geologic Cross Section Along Line A-A'
Figure 4-2	Cross Section A-A'
Figure 4-3	Groundwater Contour Map for Suspected Source Area A Wells
Figure 4-4	Groundwater Contour Map for Suspected Source Area B Wells
Figure 5-1	PCE Concentration Contour Map for B Wells Located in the Suspected Source Area, 1992
Figure 5-2	Municipal Well Sampling Results for TCE and PCE - Newmark Wellfield #1
Figure 5-3	Municipal Well Sampling Results for TCE and PCE - Newmark Wellfield #2
Figure 5-4	Municipal Well Sampling Results for TCE and PCE - Newmark Wellfield #3
Figure 5-5	Municipal Well Sampling Results for TCE and PCE - Newmark Wellfield #4
Figure 5-6	Municipal Well Sampling Results for TCE and PCE - Leroy
Figure 5-7	Municipal Well Sampling Results for TCE and PCE - Waterman Avenue
Figure 5-8	Municipal Well Sampling Results for TCE and PCE - 30th Street and Mountain View
Figure 5-9	Municipal Well Sampling Results for TCE and PCE - 31st Street and Mountain View
Figure 6-1	Suspected Source Area
Figure 6-2	Suspected Source Area Indoor Air Sampling Locations

## TABLE OF CONTENTS (Cont'd.)

Figure 6-3	TCE/PCE Release
Figure 6-4	Head Contour and Pathline Plot for Extraction Scenario No. 9, Layer 1
Figure 6-5	Head Contour and Pathline Plot for Extraction Scenario No. 9, Layer 2
Figure 6-6	Head Contour and Pathline Plot, Run 48A
Figure 13-1	Study Area/Plume/Extraction Scenario Locations
Figure 13-2	Head Contour and Pathline Plot for Extraction Scenario No. 9, Layer 1 (Upper Aquifer)
Figure 13-3	Head Contour and Pathline Plot for Extraction Scenario No. 9, Layer 2 (Lower Aquifer)
Figure 13-4	Head Contour and Pathline Plot for Extraction Scenario No. 6, Layer 1 (Upper Aquifer)
Figure 13-5	Head Contour and Pathline Plot for Extraction Scenario No. 6, Layer 2 (Lower Aquifer)
Figure 13-6	Head Contour and Pathline Plot for Extraction Scenario No. 7, Layer 1 (Upper Aquifer)
Figure 13-7	Head Contour and Pathline Plot for Extraction Scenario No. 7, Layer 2 (Lower Aquifer)
Figure 13-8	Head Contour and Pathline Plot for Extraction Scenario No. 8, Layer 1 (Upper Aquifer)
Figure 13-9	Head Contour and Pathline Plot for Extraction Scenario No. 8, Layer 2 (Lower Aquifer)
Figure 13-10	South Plant: Extraction Well Location & Pipeline Route
Figure 13-11	North Plant: Extraction Well No. 5 Location & Pipeline Route
Figure 13-12	Alternative 2 - Aqueous GAC with Municipal End Use: South Plant
Figure 13-13	Alternative 2 - Aqueous GAC with Municipal End Use: North Plant
Figure 13-14	Alternative 3 - Air Stripping with Vapor Phase GAC Off-Gas Treatment and Municipal End Use: South Plant
Figure 13-15	Alternative 3 - Air Stripping with Vapor Phase GAC Off-Gas Treatment and Municipal End Use: North Plant
Figure 13-16	Alternative 4 - Advanced Oxidation (Ozone/Peroxide) and Municipal End Use: South Plant
Figure 13-17	Alternative 4 - Advanced Oxidation (Ozone/Peroxide) and Municipal End Use: North Plant
Figure 13-18	Alternative 5 - Aqueous GAC with ReInjection: South Plant
Figure 13-19	Alternative 5 - South Plant: Injection Well Location & Pipeline Route
Figure 13-20	Comparison of Capital Cost
Figure 13-21	Comparison of Annual O&M Cost
Figure 13-22	Comparison of Present-Worth of Alternatives
Plate 1	Features Map

## VOLUME 2

Appendix A	Investigation Procedures
Appendix B	Borehole Geophysical Logs
Appendix C	Region IX Laboratory Analytical Results - Soil
Appendix D	Region IX Laboratory Analytical Results - Water
Appendix E	Region IX Laboratory Data Validation Reports
Appendix F	FASP Mobile Laboratory Results - Soil
Appendix G	FASP Mobile Laboratory Results - Water
Appendix H	FASP Mobile Laboratory Data Reports
Appendix I	Sample Alteration Forms



## **TABLE OF CONTENTS (Cont'd.)**

### **VOLUME 3**

Appendix J Newmark Project Flow Model Technical Memorandum

### **VOLUME 4**

Appendix J: Attachment A List of Input and Output Filenames for the Steady-State Model  
Attachment B List of Input and Output Filenames for Transient-State Model  
Attachment C Input and Output Files for Calibrated Transient-State Model (Run 25B0511)

Appendix K Air Sampling Report  
Appendix L Soil Gas Survey  
Appendix M Development of Extraction Scenarios

### **VOLUME 5**

Appendix N Input and Output Files for Extraction Scenario No. 1 (Run 30C0609)

### **VOLUME 6**

Appendix O Municipal & DHS Well Logs  
Appendix P Preliminary Baseline Risk Assessment

## ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
atm	atmospheric pressure
bgs	below ground surface
BNA	Base Neutral Acids
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CRQL	Contract Required Quantitation Limit
DHS-PWSB	Department of Public Health - Public Water Supply Branch
DHS-TSCD	Department of Public Health - Toxic Substance Control Division
DNAPL	dense nonaqueous phase liquid
DQOs	Data Quality Objectives
E&E	Ecology and Environment, Inc.
EPA	U.S. Environmental Protection Agency
EPA-ESB	U.S. Environmental Protection Agency Environmental Services Branch
FASP	Field Analytical Support Program
ft <sup>3</sup> /day	cubic feet per day
(ft/day)/ft	feet per day per foot
ft/ft	foot per foot
ft/yr	feet per year
g/cm <sup>3</sup>	gram per cubic centimeter
g/m <sup>3</sup>	grams per cubic meters
g/ml	gram per milliliter
gal/day/ft	gallons per day per foot
ID	Inside Diameter
m <sup>3</sup> /mole	cubic meters per molecular weight
MCLs	Maximum Contaminant Levels
mg/L	milligram per liter
mgd	million gallons per day

### ABBREVIATIONS (Cont'd.)

mL	milliliter
mm	millimeter
mmHg	millimeters of Mercury
MODFLOW	Model Flow computer program
mph	miles per hour
NAPL	nonaqueous phase liquid
NCP	National Contingency Plan
Newmark	Newmark Operable Unit
NPL	National Priority List
OHM/M	ohm per meter
PCBs	Polychlorinated Biphenyls
PCE	Perchloroethylene
PM <sub>10</sub>	particulate matter
ppb	parts per billion
ppbv	parts per billion by volume
PRPs	potentially responsible parties
psi	pounds per square inch
QA	Quality Assurance
QC	Quality Control
RAS	Routine Analytical Services
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendment Reauthorization Act
SAS	Special Analytical Services
SBVMWD	San Bernardino Valley Municipal Water District
SCAQMD	South Coast Air Quality Management District
SITE	Superfund Innovative Technology Evaluation

### ABBREVIATIONS (Cont'd.)

SOW	Statement of Work
SP	Specific Potential
T(°K)	temperature in degrees Kelvin
TCE	Trichloroethylene
TCL	Target Compound List
TD	total depth
TICs	Tentatively Identified Compounds
TPH	Total Petroleum Hydrocarbons
TTLC	Total Threshold Limit Concentration
URS	URS Consultants, Inc.
VOAs	Volatile Organic Analytes
VOCs	Volatile Organic Compounds
µg/L	microgram per liter

## **EXECUTIVE SUMMARY**

### **INTRODUCTION**

In 1980, the California State Department of Health Services detected concentrations of trichloroethylene (TCE) and perchloroethylene (PCE) in municipal water supply wells (municipal wells) in the northern San Bernardino/Muscoy region which exceeded California's public health action levels for drinking water. Subsequently, a number of investigations were conducted to determine the source(s) of the contamination. On March 30, 1989, the U.S. Environmental Protection Agency (EPA) listed the Newmark Groundwater Contamination Superfund Site on the National Priorities List (NPL), thereby providing federal funds for cleanup.

The Newmark Operable Unit (Newmark) Remedial Investigation/Feasibility Study (RI/FS) was conducted to address EPA's site-specific objectives and collect data necessary to develop and evaluate alternatives for cleanup of the site. Newmark is situated within the limits of the City of San Bernardino in the northeast portion of the San Bernardino Valley.

The RI/FS was completed in three phases, with each phase providing information to guide the subsequent phase. The three phases were:

- Scoping Phase - During this initial phase, data was collected to support the RI/FS, and preliminary modeling was performed to formulate a conceptual understanding of the groundwater flow in the area;
- Remedial Investigation Phase - The RI phase involved a field investigation to collect data to characterize the soil and groundwater contamination and develop remedial alternatives; and

- Feasibility Study Phase - The FS phase included the development and screening of remedial alternatives and preparation of a detailed analysis in support of cleanup.

## SCOPING PHASE

Previous reports and other information were reviewed to focus the activities of the RI and FS phases. Much of the information indicated the presence of a waste pit (later referred to as the "Cat pit") and a disposal trench at the former San Bernardino Airport which may have been the principal or major contributor(s) to the groundwater contamination. One of the objectives of the field investigation was to gather sufficient data to characterize the suspected source area.

Groundwater in the northern San Bernardino/Muscoy region is principally used for municipal and industrial purposes. Laboratory analyses of groundwater samples collected from monitoring and municipal wells identified a number of organic contaminants, including 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1-dichloroethane, Freon 11, Freon 12, TCE, and PCE. However, TCE and PCE were the only contaminants detected within the aquifer at concentrations exceeding federal maximum contaminant levels (MCLs) for drinking water. As a result, the affected municipal wells have either been inactivated or the groundwater from these wells has been treated.

## REMEDIAL INVESTIGATION PHASE

Newly installed monitoring wells and existing municipal wells were sampled in order to confirm the source of groundwater contamination. Chemical testing of soils and water included a broad suite of chemicals. Analytical data from groundwater samples from municipal and cluster monitoring wells, installed during a previous investigation, provided data on plume migration downgradient of the suspected source area.

Groundwater upgradient of the suspected source area was found to be contaminated. The data from soil samples collected in the suspected source area indicated no residual TCE or PCE contamination. These results suggest: 1) the suspected source area may no longer be contributing significantly to groundwater contamination; and 2) the presence of an upgradient source. The contaminant plume appears to enter through the topographic low formed between Shandin Hills and Wiggins Hill but not the Devils Canyon area.

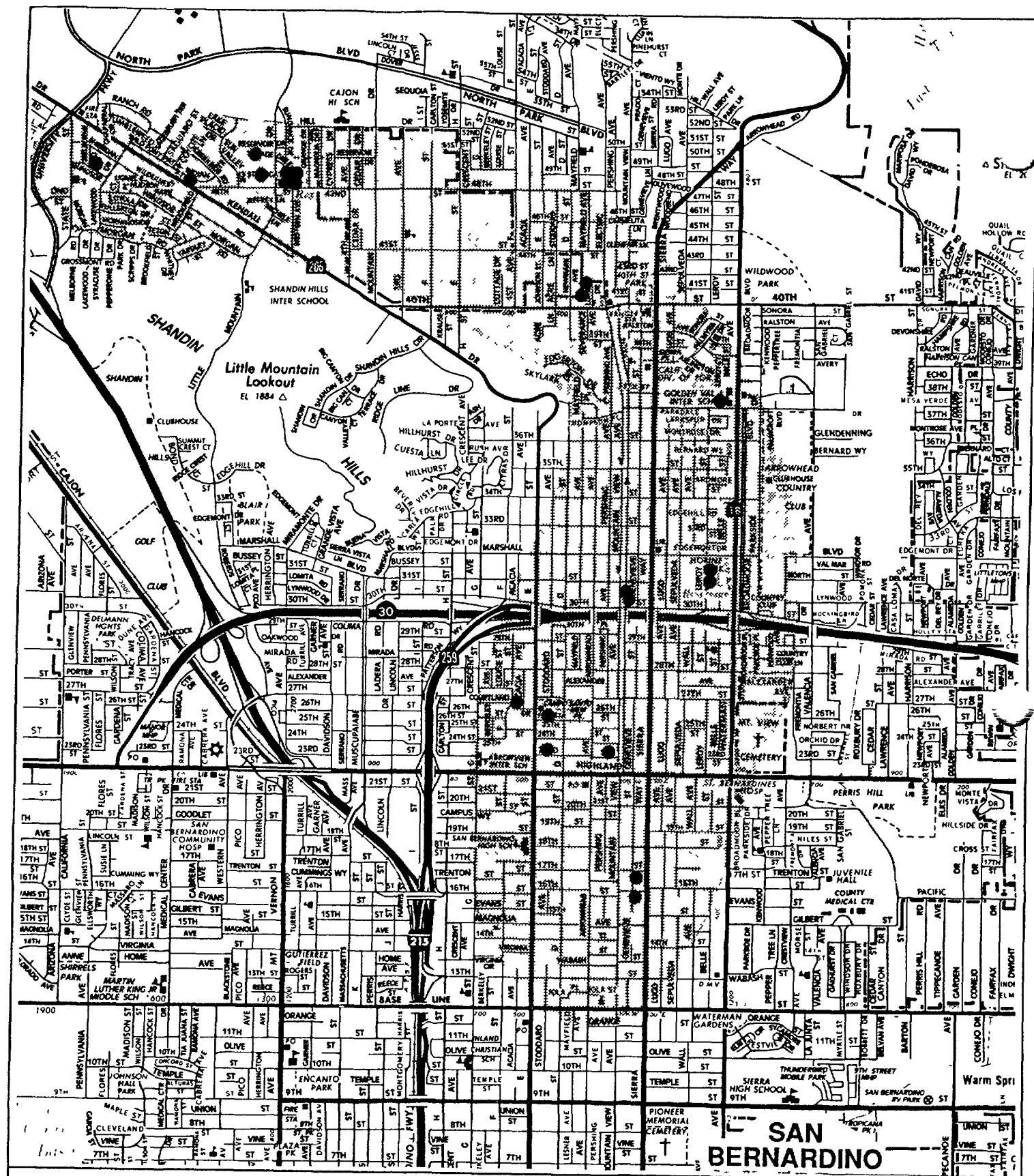
Based on the integration of all available data, a contamination plume map was developed (Figure ES-1). The existing Newmark plume bending around the Shandin Hills is approximately six miles long and one mile wide at its widest point. The highest concentration of contaminants appears to be located within the deeper portion of the aquifer in the upgradient portion of the plume. Since the mid-1980s a general decrease in concentrations of both TCE and PCE has been observed in the Newmark Wellfield wells while a general increase has been noted downgradient in the 30th Street and Mountain View, 31st Street and Mountain View, and Leroy municipal wells, as well as the Waterman Wellfield.

A project flow model was developed to estimate groundwater flow and contaminant movement, and to screen the remedial alternatives in the Newmark plume. The model used MODFLOW, a computer program developed by the U.S. Geological Survey.

To calculate the remediation times of various extraction scenarios the model was used to estimate the average groundwater velocity for an area of the Newmark plume. The average groundwater velocity is estimated to be about one foot per day (358 ft/yr). Due to the chemical and physical interactions between the aquifer and the contaminants, in a process called retardation, TCE and PCE migration rates are expected to average slightly less than one-half of the groundwater velocity.

## **FEASIBILITY STUDY PHASE**

The feasibility study process considered site-specific remedial action objectives regarding human health and environmental protection. These objectives, based on MCLs, are as follows:





- Prevent ingestion of groundwater having TCE and PCE in excess of five micrograms per liter ( $\mu\text{g/L}$ ) for each contaminant; and
- Reduce groundwater aquifer contaminant levels to below five  $\mu\text{g/L}$  for both TCE and PCE.

After a series of initial screening steps, viable remedial alternatives were subjected to a detailed analysis. The detailed analysis focused on the performance of each remedial alternative with respect to EPA's evaluation criteria and their ability to meet these objectives. The alternatives evaluated in detail were:

- Alternative 1: No Action. This alternative consists of quarterly sampling and water level monitoring of fifteen (15) existing monitoring wells, four (4) new monitoring wells, and twenty-six (26) existing municipal wells.
- Alternative 2: Aqueous-Phase Granular Activated Carbon (GAC) with Municipal End Use. This alternative makes use of four (4), 2,000 gpm groundwater extraction wells, placed ahead of the leading edge of the plume; one (1) additional, 800 gpm groundwater extraction well, placed in the Newmark Wellfield; and the existing municipal wells in the Newmark Wellfield. Extracted groundwater from the leading edge of the plume would be delivered through underground piping to the southern Treatment Plant; the closest of the two (aqueous GAC) Treatment Plants. The extracted groundwater from the Newmark Wellfield would be delivered through underground piping to the northern Treatment Plant. The treated groundwater is subsequently delivered into the municipal water supply system.
- Alternative 3: Air Stripping with GAC Off-Gas Treatment and Municipal End Use. This alternative makes use of four (4), 2,000 gpm groundwater extraction wells, placed ahead of the leading edge of the plume; one (1) additional, 800 gpm groundwater extraction well, placed in the Newmark Wellfield; and the existing municipal wells in the Newmark Wellfield. Extracted groundwater from the leading edge of the plume would be delivered through underground piping to the southern Treatment Plant; the closest of the two (air stripping) Treatment Plants. The extracted groundwater from the Newmark Wellfield would be

delivered through underground piping to the northern Treatment Plant. The treated groundwater would subsequently be delivered into the municipal water supply system.

- **Alternative 4: Advanced Oxidation (Ozone/Peroxide) with Municipal End Use.** This alternative makes use of four (4), 2,000 gpm groundwater extraction wells, placed ahead of the leading edge of the plume; one (1) additional, 800 gpm groundwater extraction well, placed in the Newmark Wellfield; and the existing municipal wells in the Newmark Wellfield. Extracted groundwater from the leading edge of the plume would be delivered through underground piping to the southern Treatment Plant; the closest of the two (advanced oxidation) Treatment Plants. The extracted groundwater from the Newmark Wellfield would be delivered through underground piping to the northern Treatment Plant. The treated groundwater would subsequently be delivered into the municipal water supply system.
- **Alternative 5: Aqueous-Phase GAC with Reinjection.** This alternative makes use of four (4), 2,000 gpm groundwater extraction wells, placed ahead of the leading edge of the plume; one (1) additional, 800 gpm groundwater extraction well, placed in the Newmark Wellfield; and the existing municipal wells in the Newmark Wellfield. Extracted groundwater from the leading edge of the plume would be delivered through underground piping to the southern Treatment Plant; the closest of the two (aqueous GAC) Treatment Plants. The extracted groundwater from the Newmark Wellfield would be delivered through underground piping to the northern Treatment Plant. The treated water would subsequently be reinjected into the groundwater aquifer through six injection wells placed downgradient from the extraction wells.

Following the detailed analysis, the alternatives were compared to each other. The comparative analysis, as presented in Table ES-1, quantifies the relative advantages and disadvantages of the alternatives. The EPA will use this information to develop the Proposed Plan (PP) which will identify a preferred alternative. The PP will be used to support the Record of Decision (ROD).

**Table ES-1**  
**Alternative Comparative Analysis**  
**Newmark Operable Unit RI/FS Report**

Remedial Alternative	Overall Protection of Human Health and the Environment <sup>a</sup>	Compliance with ARARs <sup>a</sup>	Long-term Effectiveness and Permanence <sup>b</sup>	Reduction of Toxicity, Mobility, or Volume <sup>b</sup>	Short-term Effectiveness <sup>b</sup>	Implementability <sup>b</sup>	Approximate Cost (\$ million)	Composite Score
Alternative 1: No Action	No	No	1	1	5	3	\$3.5	10
Alternative 2: Aqueous GAC with Municipal End Use	Yes	Yes	4	4	4	4	\$49.9	16
Alternative 3: Air Stripping with Vapor Phase Off-Gas Treatment and Municipal End Use	Yes	Yes	4	3	4	3	\$47.9	14
Alternative 4: Advanced Oxidation (Ozone/Peroxide) with Municipal End Use	Yes	Yes	4	5	3	2	\$61.0	14
Alternative 5: Aqueous GAC with Reinjection	Yes	Yes	4	4	4	4	\$48.1	16

Notes: a. Yes = Meets the criteria; No = Does not meet the criteria.  
b. Evaluated on scale from 1 (minimally) to 5 (maximally) in meeting the criteria.

## 1.0 INTRODUCTION

In 1980, the California State Department of Health Services investigated and discovered solvent contaminants in the municipal water-supply wells (municipal wells) in the northern San Bernardino/Muscoy region. Since that time several investigations have been conducted regarding the potential source of contamination. On March 30, 1989, the U.S. Environmental Protection Agency (EPA) listed the region as the Newmark Groundwater Contamination Superfund Site, thereby providing federal funds for cleanup.

URS Consultants, Inc. (URS), the EPA contractor for this Newmark Operable Unit (Newmark) Remedial Investigation/Feasibility Study (RI/FS), has been included in the aforementioned investigations as early as 1985, when California agencies contracted URS to study hydrogeology and potential contamination sources of the groundwater in the region. This early investigation enabled State and local agencies to implement interim remedial actions (air stripping towers) in November 1986, and resume investigations through the use of funds from the California Hazardous Substance Account (State Superfund).

The principal contaminants identified in all investigations since 1980 and the contaminants of concern for this report are trichloroethylene (TCE) and perchloroethylene (PCE). These contaminants exceed California public health actions levels for drinking water in several municipal wells. The highest concentrations have been identified in wells within the San Bernardino Newmark Municipal Wellfield (Newmark Wellfield) [TCE and PCE are discussed in detail in Section 6.1.]

This RI focused on the potential source of contamination (the Cat pit and disposal trench, see Subsection 1.2.2) and the downgradient groundwater contamination plume. As data was developed during the course of this RI, specifically from monitoring wells MW02A/B through MW06A/B, it was determined that no residual soil contamination in the suspected source area existed and that groundwater coming from upgradient of the suspected source area was contaminated with TCE and PCE. Consequently, two additional monitoring wells, MW07A/B and MW08A/B, were installed to verify the presence of upgradient contamination source (Plate 1).

## 1.1 PURPOSE

By authority granted under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendment Reauthorization Act of 1986 (SARA), EPA conducted a focused RI/FS of Newmark Wellfield. As stated in the National Contingency Plan (NCP), the purpose of an RI/FS is to assess site conditions and evaluate alternatives to the extent necessary to select a remedy.

This focused RI/FS was prepared to address site specific objectives and collect only that data necessary to develop and evaluate alternatives in support of the remedial design. This report identifies the potential sources of groundwater contamination and provides long-term solutions through the selection of feasible remedial alternatives. Activities associated with this focus were designed to fulfill the following project objectives:

- Limit plume migration through the design of an effective system of extraction wells and treatment facilities;
- Provide data for the Record of Decision (ROD) to support selection of the remedial design (RD) and construction of the selected remedy;
- Identify and control the source(s) of the contamination; and
- Remove groundwater contamination to restore the aquifer to beneficial uses, if applicable.

The Newmark RI/FS was completed in three phases, with each phase providing information to guide the subsequent phase. The three phases were:

- Scoping Phase -- data gathering and preliminary modeling
- Remedial Investigation Phase -- field investigation and analysis
- Feasibility Study Phase -- detailed analysis and screening of alternatives to select a remedy

## **1.2 BACKGROUND**

### **1.2.1 History of Regulatory Actions and Investigations**

Groundwater contamination in the northern San Bernardino/Muscoy region was first detected in 1980 by the Department of Health Services - Office of Drinking Water (DHS-ODW) [formerly...Public Water Supply Branch (DHS-PWSB)]. Eight City of San Bernardino municipal wells were found to contain levels of TCE and PCE in exceedance of State Drinking Water Action Levels (currently 5.0 ppb for each). Four of these wells were in the Newmark Wellfield at Reservoir Drive and Magnolia Avenue and the other four were in the Waterman Wellfield in the vicinity of 31st Street and Waterman Avenue. As a consequence of the contamination, pumping of these wells was discontinued, resulting in a loss of approximately 25 percent (28 million gallons per day [mgd]) of the City of San Bernardino's municipal water supply. A more extensive groundwater sampling program was initiated by the Regional Water Quality Control Board (RWQCB), Santa Ana Region, and the DHS-ODW to closely monitor groundwater quality in the San Bernardino area. This program discovered TCE and PCE in eight additional wells in concentrations high enough to necessitate shutdown. The pattern of well contamination suggests relatively rapid southward (downgradient) migration of TCE and PCE, which, if left unchecked, could pose a significant threat to downgradient municipal wells.

In September 1985, the RWQCB, Santa Ana Region, authorized a contract between the RWQCB and URS to study the local hydrogeology and ascertain potential contaminant sources. This report, completed in August 1986, identified 50 possible sources of groundwater contamination, including the now abandoned San Bernardino Airport (URS 1986).

In November 1986, the Department of Health Services - Department of Toxic Substances Control (DHS-DTSC) [formerly...Toxic Substances Control Division (DHS-TSCD)] signed a Determination of Imminent and Substantial Endangerment for the northern San Bernardino/Muscoy region based upon municipal well closings and the potential threat to downgradient wells. This action released State superfund money for interim remedial action in the Newmark Wellfield project and allowed DHS-DTSC

1 and the City of San Bernardino to construct four air stripping towers; two, which became operational  
2 in 1988, at the Newmark Wellfield; and two, which came on line in July 1989, at the Waterman Avenue  
3 site.

4 Several additional studies have been undertaken in the northern San Bernardino/Muscoy region area.  
5 In 1987, the County completed a study of small quantity hazardous waste users in San Bernardino  
6 (including TCE and PCE users) in order to quantify and regulate the amount of these contaminants used  
7 in the area (E&E 1989). The zone contractor for DHS-DTSC, Ecology and Environment, Inc. (E&E)  
8 completed a Preliminary Assessment of the site in 1989. During 1988, nine monitoring wells were  
9 drilled at three separate locations by the zone contractor (E&E 1989).

10 In March 1989, the Newmark Wellfield was placed on the U.S. Environmental Protection Agency's  
11 (EPA) National Priority List (NPL), thereby allowing federal Superfund money to be spent on site  
12 remediation. The EPA conducted a search to identify potentially responsible parties (PRPs) that  
13 contributed to the Newmark Wellfield contamination. In 1990, the EPA's Environmental Monitoring  
14 Systems Laboratory (EMSL) performed a review of aerial photography of the Newmark Wellfield to  
15 locate evidence of potential contamination sources. EPA has been conducting an RI/FS for the Newmark  
16 Groundwater Contamination project since 1990.

#### 17 **1.2.2 History of Suspected Source of Contaminants**

18 An intensive analysis of historical photographs of the Newmark Wellfield area was performed by EMSL  
19 (EMSL 1990). The imagery data analyzed were derived from aerial photographs collected over a 44-  
20 year period (1946-1989). The photographic analysis focused on discovery of any possible sources of  
21 solvent contamination that could affect the municipal wells of San Bernardino. The results of the  
22 analysis are summarized below.

23 The 1946 photographs of the Newmark Wellfield area revealed a small active airfield with many aircraft  
24 but no visible waste disposal (i.e., drums, liquid filler, pits or trenches, soil staining). The airfield  
25 appeared to still be active in the 1949 photographs. The only change noted by 1952 was the presence

1 of residential development south of the airfield. By 1953 a new dirt runway was present but no waste  
2 disposal was evident. The 1959 photographs revealed the presence of a suspected large disposal trench  
3 near the main runway and a light colored liquid filled pit near the hangars of the airfield. The trench  
4 was covered by 1966 but the pit (later referred to as "Cat pit") appeared to contain a dark liquid. The  
5 hangar area of the airfield had been fenced and a new road bisected the area. Little change was noted  
6 at the hangar area in 1968 but new development around the area was evident. By 1980, the Cat pit had  
7 been covered and new residential development was present throughout the area. The photos of 1985  
8 reveal the old hangar area had been torn down and residential development had been built. Continued  
9 residential development was very apparent on the 1989 color photographs (EMSL 1990).

10 Activities at the airport that could have contributed to the contaminant problem were summarized by  
11 E&E in 1989 and are describe below. Prior to its closure in 1958, activities at the San Bernardino  
12 Airport were reported to include the use of a wide variety of solvents and the storage, leakage, and  
13 dumping of various waste solvents. One probable source was a carburetor repair shop, which reportedly  
14 was contracted by Norton Air Force Base for aircraft engine repair, maintenance, and aircraft washing  
15 services (E&E 1989).

16 Eyewitness accounts confirmed that the now-closed private San Bernardino Airport and the Cat pit were  
17 once locations of extensive solvent disposal (URS 1986). In order to confirm whether the Cat pit was  
18 the source of groundwater contamination in the Newmark Wellfield, monitoring wells were installed  
19 (MW02 through MW06), located downgradient (MW04 and MW05) and upgradient (MW03 and MW06)  
20 of the Cat pit.

### 21 **1.2.3 RI/FS Areas**

22 To facilitate RI/FS activities, the region was divided into five distinct, yet integral, areas:

23 **Study** -- the study area covers approximately 80 square miles extending from the San Bernardino  
24 Mountains on the north to just south of Interstate 10 on the south. The western and eastern boundaries  
25 coincide with the borders of the San Bernardino North and South 7 1/2-minute quadrangles (Figure 1-1).  
26 The study area encompasses all other areas described below. The purpose of the study area was to allow



1 the collection of all data pertinent to the modeling effort. A detailed description of the study area and  
2 of the data collected is presented in Appendix J, Newmark Project Flow Model Technical Memorandum,  
3 Parts I and II.

4 **Model** -- the model area is within the study area. It is isolated on the north by the San Andreas Fault  
5 and the San Jacinto Fault on the south. The western and eastern boundaries lie along those same  
6 boundaries of the study area (Figure 1-1). All active modeling was performed for the model area. A  
7 detailed description of the modeling activities is presented in Appendix J.

8 **Investigation** -- the investigation area delineates the geographic boundaries for this remedial investigation  
9 and its associated field activities. This 20-square mile area extends approximately 0.20 miles north and  
10 west of University Parkway and continues southeast to approximately 40th Street, at which point it  
11 extends south and continues for approximately 3 miles toward Baseline Street (Figure 1-2). All field  
12 activities were conducted within this area.

13 **Suspected Source** -- the suspected source area lies in the northern investigation area. It is centered  
14 around the former site of the San Bernardino Airport with the eastern boundary at the Newmark  
15 Wellfield (Figure 1-3). Activities intended to locate the source of the Newmark Groundwater  
16 Contamination Plume (Plume) centered around the area. Monitoring well MW02A/B through MW07A/B  
17 were installed within the suspected source area.

18 **Plume** -- the plume area is included within the investigation area. It includes all contaminated municipal  
19 wells and the location of monitoring well MW01 (Figure 1-4).